California Energy Commission

IEPR Lead Commissioner Workshop

Jobs and Renewable Energy in California

"Analyzing Job Impacts Using NREL's JEDI Models"

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Energy, jobs and economic development are very much connected.

What is JEDI?

- **J**obs and **E**conomic **D**evelopment **I**mpact models
- Spreadsheet-based tools developed for the National Renewable Energy Laboratory (NREL)
- Designed to calculate local economic impacts associated with the installation and annual operations of energy generating systems

JEDI Models

http://www.nrel.gov/analysis/jedi/

Renewable Energy

- Solar – Photovoltaic (PV)
  Concentrated Solar Power (CSP)
- Wind – Onshore Large
- Hydro – Marine Hydrokinetic
- Biofuels – Corn Ethanol
  Cellulosic Ethanol

Conventional Energy

- Natural Gas
- Coal

JEDI Models (in development)

- Solar – Photovoltaic (PV) Scenario
- Wind – Small Wind and Offshore Wind
- Biopower
- Geothermal
- Conventional Hydro
- Petroleum
- Transmission

JEDI: Key Design Elements

- Tool to easily identify statewide economic impacts of constructing and operating energy systems
- Available to a broad range of people
- Default data that can be easily modified
- Flexible input options
- User Add-in Location feature (for county or regional analysis)

Who Uses JEDI Models?

- Resource Planners and Analysts
- Project Developers
- Renewable Energy Advocates
- Local Planning Depts.
- State Energy Offices
- State and Local Economic Development Commissions
- Researchers (government, university, etc.)

JEDI Project Analysis:

It all begins with a specific project.

The User inputs.....

Minimum Information **or** **More Detailed Information**

- Location (State or County*)
- Year of construction
- System Type (for PV)
  - Residential New
  - Residential Retrofit
  - Small Commercial
  - Large Commercial
  - Utility
- Size of PV system (KW)

*requires additional input-output data

Installation

- Materials and Equipment Costs (modules, mounting, electrical, etc.)
- Labor Costs
- Other Costs (permits, services, overhead, etc.)

Annual Operating & Maintenance

- Labor Costs
- Materials and Equipment Costs

Other Parameters (Financial, Tax, and Payroll)

Methodology

Input-Output - Multiplier Analysis

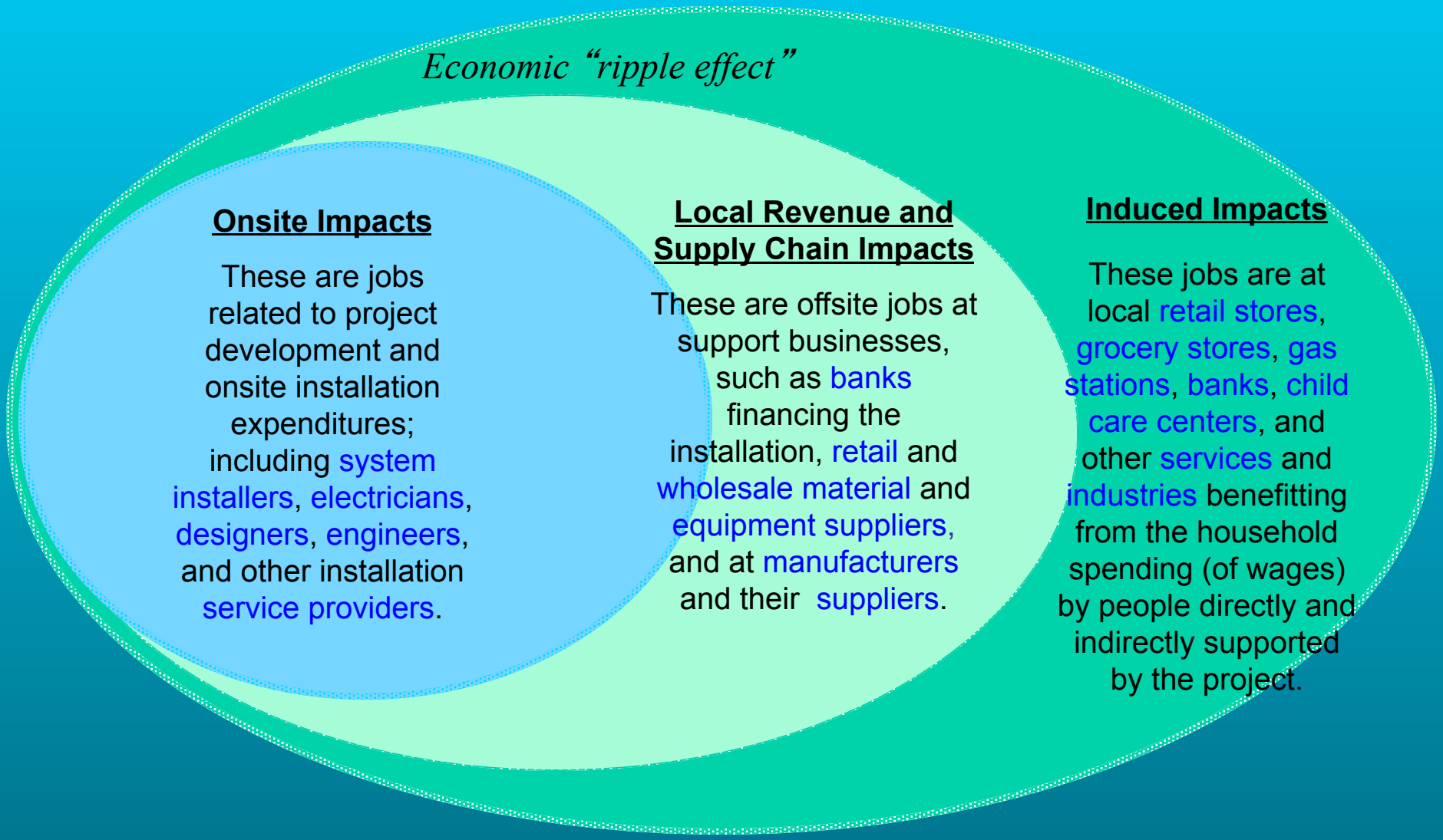
"Input-output analysis can be thought of as a method of evaluating and summing the impacts of a series of effects generated by an expenditure (i.e., input)."

To determine the total effect of constructing/ installing a system …

Three separate impacts are examined for each expenditure:

- ✓ **Direct**
- ✓ **Indirect**
- ✓ **Induced**

JEDI Economic Impacts



"The benefits that are ultimately generated by expenditures for energy systems depend upon the extent to which those expenditures are spent locally and the structure of the local economy."

And then.....

Changes in expenditures (demand) are matched with their appropriate multipliers for each industry sector affected by the change in expenditure.

State specific multipliers and personal expenditure patterns are used to generate the results. The multipliers for

- **employment**
- **wage and salary income**
- **output (economic activity)**
- **personal expenditure patterns**

are derived using the IMPLAN model.*

*IMPLAN is a social accounting and impact analysis tool developed by the Minnesota IMPLAN Group (MIG, Inc), Hudson, Wisconsin (implan.com).

Summary Results

Project Data

- Project Installation Costs (total and local share)
- Annual O&M Spending
- Debt Payments
- Property and Sales Tax

Impacts

Construction Period

- Jobs
- Earnings
- Output

Operating Years (annual)

- Jobs
- Earnings
- Output

Some Important Points to Keep in Mind.....

–The assumptions used in the analysis play an important role in influencing the results.

–Project size, location, financing arrangements and site-specific factors influence the installation and operating costs.

–The model is designed to incorporate model default values or new values entered by the user.

More Points to Keep in Mind.....

–Model default values represent a reasonable expenditure pattern for installing and operating the various size systems within a state (in the United States) and the share of expenditures spent locally.*

– The availability of local resources, including labor and materials and locally manufactured equipment and other components, can have a significant effect on the costs and the economic benefits that accrue to the state or region being analyzed.

*Local share" values can be revised to localize the model.

"To the extent the user has and can incorporate project specific data, and the share of spending that is expected to occur locally, the more localized the impact analysis will be."

And now let's take a look at one of the models…..

Photovoltaic Project Data

Please read instructions before getting started

INSTRUCTIONS:

1. Begin by entering *Project Location* (from pull-down list) and other *Project Descriptive Data* relevant to your particular project. After inputting Descriptive Data press enter (or cursor to the next cell) to continue.

2. Once *Descriptive Data* is complete, you may choose to utilize the detailed model default values for *Project Cost* (based on your *Descriptive Data)* by choosing "Y" on line 26 OR you may choose to use your own values entered (modified) under *Project Cost Data by choosing* "N" on line 26. Choose "Y" to accept *Project Cost* default values or "N" to over-ride *Project Cost* default values and use your own inputs.

3. Press 'Go To Summary Impacts' Button

NOTES: Additional information is available by pointing to the red triangles located in cell corners. Only those cells with a white background can accept new values.

Project Descriptive Data

Project Location	CALIFORNIA
Year of Construction or Installation	2012
System Application	Residential Retrofit
Solar Cell/Module Material	Crystalline Silicon
System Tracking	Fixed Mount
Average System Size - DC Nameplate Capacity (kW)	5.0
Number of Systems Installed	100.0
Total Project Size - DC Nameplate Capacity (kW)	500.0
Base Installed System Cost ($/kW$_{DC}$)	$6,561
Annual Direct Operations and Maintenance Cost ($/kW)	$32.80
Money Value (Dollar Year)	2010

Typically less than 10 kW

Utilize *Project Cost Data* default values? Choose "Y" to accept model default values or "N" to view the default values and utilize new user defined values (entered below).

Y

Press 'Go To Summary Impacts' Button

Go To Summary Impacts

Project Cost Data

Installation Costs	Cost	Cost Per kW	Percent of Total Cost	Purchased Locally (%)	Manufactured Locally (Y or N)
Materials & Equipment					
Mounting (rails, clamps, fittings, etc.)	$114,991	$230	3.4%	100%	N
Modules	$1,074,912	$2,150	31.6%	100%	N
Electrical (wire, connectors, breakers, etc.)	$114,991	$230	3.4%	100%	N
Inverter	$209,983	$420	6.2%	100%	N
Subtotal	$1,514,876	$3,030	44.5%		
Labor					
Installation	$275,113	$550	8.1%	100%	
Subtotal	$275,113	$550	8.1%		
Total	$1,789,989	$3,580	52.6%		
Other Costs					
Permitting	$91,863	$184	2.7%	100%	
Other Costs	$183,727	$367	5.4%	100%	
Business Overhead	$1,215,121	$2,430	35.7%	100%	
Subtotal	$1,490,711	$2,981	43.8%		
Subtotal	$3,280,700	$6,561	96.3%		
Sales Tax (Materials & Equipment Purchases)	$124,977	$250	3.7%	100%	
Total	$3,405,678	$6,811	100.0%		

PV System Annual Operating and Maintenance Costs

Labor	Cost	Cost Per kW	Percent of Total Cost	Local Share (%)	
Technicians	$8,965	$17.93	52.7%	100%	
Subtotal	$8,965	$17.93	52.7%		
Materials and Services				Purchased Locally (%)	Manufactured Locally (Y or N)
Materials & Equipment	$7,435	$14.87	43.7%	100%	N
Services	$0	$0.00	0.0%	100%	
Subtotal	$7,435	$14.87	43.7%		
Sales Tax (Materials & Equipment Purchases)	$613	$1.23	3.6%	100%	
Total	$17,013	$34.03	100.0%		

Other Parameters

Financial Parameters		**Local Share**
Debt Financing		
Percentage financed	80%	0%
Years financed (term)	10	
Interest rate	5%	
Tax Parameters		
Local Property Tax (percent of taxable value)	0%	
Assessed Value (percent of construction cost)	0%	
Taxable Value (percent of assessed value)	0%	
Taxable Value	$0	
Property Tax Exemption (percent of local taxes)	100%	
Local Property Taxes	$0	100%
Local Sales Tax Rate	8.25%	100%
Sales Tax Exemption (percent of local taxes)	0%	
Payroll Parameters		
Construction and Installation Labor	**Wage per hour**	**Employer Payroll Overhead**
Construction Workers / Installers	$21.39	45.6%
O & M Labor	**Wage per hour**	**Employer Payroll Overhead**
Technicians	$21.39	45.6%

Local Economic Impacts - Summary Results

During construction and installation period	Jobs	Earnings $000 (2010)	Output $000 (2010)
Project Development and Onsite Labor Impacts			
Construction and Installation Labor	4.2	$275.1	
Construction and Installation Related Services	6.7	$313.9	
Subtotal	11.0	$589.0	$1,048.0
Module and Supply Chain Impacts			
Manufacturing Impacts	0.0	$0.0	$0.0
Trade (Wholesale and Retail)	2.9	$178.6	$538.6
Finance, Insurance and Real Estate	0.0	$0.0	$0.0
Professional Services	2.0	$100.4	$339.6
Other Services	3.2	$224.3	$777.2
Other Sectors	4.5	$164.7	$381.6
Subtotal	12.6	$668.0	$2,036.9
Induced Impacts	8.6	$380.3	$1,351.1
Total Impacts	**32.2**	**$1,637.3**	**$4,436.1**

During operating years	Annual Jobs	Annual Earnings $000 (2010)	Annual Output $000 (2010)
Onsite Labor Impacts			
PV Project Labor Only	0.1	$8.3	$8.3
Local Revenue and Supply Chain Impacts	0.1	$3.2	$10.4
Induced Impacts	0.0	$2.0	$7.1
Total Impacts	**0.2**	**$13.5**	**$25.9**

Notes: Earnings and Output values are thousands of dollars in year 2010 dollars. Construction and operating period jobs are full-time equivalent for one year (1 FTE = 2,080 hours). Economic impacts "During operating years" represent impacts that occur from system/plant operations/expenditures. Totals may not add up due to independent rounding.

- JEDI analyses are performed in **various** ways:
  - Statewide impacts (one state or comparison of several)
  - Countywide impacts
  - Individual system or grouped systems
  - Compared to natural gas, coal or other renewables
  - Precise assumptions vs. ranges and sensitivities
  - Local vs. non-local ownership and local “optimization”
  - Comparison of tax parameters

JEDI

Jobs and Economic Development Impact Model

National Renewable Energy Laboratory

Available at http://www.nrel.gov/analysis/jedi/

For More Information Contact:

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